Kanepu‘u Preserve
Lana‘i, Hawai‘i

Long-Range Management Plan
Fiscal Years 2004–2009

Submitted to the
Department of Land & Natural Resources
Natural Area Partnership Program

Submitted by
The Nature Conservancy – Hawai‘i Operating Unit
August 2002

2nd Revision January 2003

CONTENTS

TABLES, FIGURES AND APPENDICES

Tables

Figures

Appendices

EXECUTIVE SUMMARY

The Nature Conservancy of Hawai‘i (TNCH) is the Hawai‘i Chapter of The Nature Conservancy (TNC), an international private, non-profit organization based in Arlington, Virginia. The Conservancy's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the places they need to survive. Since 1980, TNCH has helped protect more than 200,000 acres in Hawai‘i. The Conservancy has a statewide system of 12 preserves totaling 30,000 acres and has helped protect another 175,000 acres through cooperative projects with federal, state, county, and private partners. On Lana‘i, TNCH manages the Kanepu‘u Preserve, which is comprised of 590 acres across seven disjunct units, encompassing rare remnant dryland forest.

The State's Natural Area Partnership Program (NAPP) is an innovative program that aids private landowners in the management of their native ecosystems. NAPP provides matching funds ($2 state to $1 private) for the management of qualified private lands that have been permanently dedicated to conservation.

Kanepu‘u was approved for NAPP funding in 1992, and soon thereafter TNCH implemented the management programs described in our initial plan, *Kanepu‘u Preserve FY1992 – FY1997 Long-Range Management Plan*. Previously, some specific management activities were conducted under Conservation District Use Permits (numbers LA-11/14/91-2534 & 2535). In 1997, NAPP funding for a new 6-year period was reauthorized following a renewal procedure which included the preparation of an updated plan (*Kanepu‘u Preserve FY1998 – FY2003 Long-Range Management Plan*) and an environmental assessment (*Final Environmental Assessment for Kanepu‘u Preserve Natural Area Partnership, 1997*). Presently, TNCH is seeking reauthorization of NAPP funding for the next 6-year period for the programs described within this *Kanepu‘u Preserve FY2004 – FY2009 Long-Range Management Plan*. This plan continues the programs implemented under the previous plan and environmental assessment. Herein, we request $**617,349** in matched state funds for the 6 years spanning FY2004 – 2009.

Over the next six years our management efforts will focus on the following activities:

1. **Ungulate Control** – TNCH's primary management activity will continue to be the complete removal of all axis deer from the Kanepu‘u unit and maintenance of zero ungulate levels in the Kahue unit, along with the exclusion of deer, mouflon sheep and cattle. Due to the corrosive effect of sand, salt and prevailing winds on the island, a significant factor in the ongoing campaign to remove ungulates will be the need for fence replacement and maintenance around the seven preserve units. In addition, TNCH will continue to work with volunteers from the community to maintain an uninterrupted hunting program, enabling us to eliminate the population of axis deer in the Kanepu‘u unit and exclude deer in other units.

   Weed Control – We will continue to work to prevent the further displacement of native vegetation by non-native plants and, where possible, reduce or eradicate weed populations. Selective removal of understory and canopy weeds will occur primarily in areas within or surrounding high quality patches of native vegetation. We will also focus our efforts on

incipient weeds both within and immediately outside the perimeter preserve fences. We will continue to monitor all previously treated weeds (re-treating as necessary) over the course of this Long-Range Management Plan, planting native species in the gaps created by weed control activities.

Small Mammal Control – A goal of the program continues to be preventing small mammals, predominantly rats and mice, from damaging rare native species in the preserve. Rats and mice can eat flowers and fruits of native plant species and thus diminish their reproductive output. Using a strategic approach, bait stations (registered for use in natural areas in Hawai‘i under Section 24c of the Federal Insecticide Fungicide and Rodenticide Act) will be placed in key locations around targeted plants as a means of limiting the impact of rodents.

Fire Control – Due to the relatively dry climate of the preserve, it is imperative for management to be especially vigilant in preventing wildfires from damaging the preserve. We will continue to maintain fuel breaks and grade along the fenceline. We will work with the State, the local fire department, and Castle & Cooke to ensure our fire preparedness. All field staff will be fire trained.

2. **Restoration, Monitoring, and Research** – Restoration work will continue to follow the *Kanepu‘u Conservation and Restoration Plan* completed in 1999. We will continue to collect native seedlings for our nursery facility in Lana‘i City for subsequent propagation and outplanting in preserve units. We will also continue monitoring restoration efforts throughout all preserve units.

3. **Community Outreach** – Our community outreach efforts are focused on developing conservation awareness on Lana‘i. Our outreach program takes a comprehensive approach and includes enhancing existing volunteer programs, which involve a variety of individuals and organizations; conducting monthly-guided hikes; and implementing stewardship programs with Lana‘i High and Elementary Schools. In addition we are focusing on building the organizational capacity of a local community group, Hui Malama Pono O Lana‘i, in an effort to increase its ability to take a larger role in the management and protection of the island’s resources.

4. **Watershed Partnerships** –The Lana‘i Forest Watershed Partnership (LFWP) was formed in 2001 to assist in protecting the island’s watersheds by leveraging efforts among conservation partners. As an active coordinator of this group, TNCH will continue to work with partners to promote stewardship activities in forest and watershed regions of Lana‘i.

The State Department of Land and Natural Resources (DLNR), which administers the NAPP program, is kept apprised of our progress in the preserve through written reports and an annual inspection. Operational plans are submitted annually (the Conservancy has adopted a July 1 – June 30 fiscal year). In addition, a 6-month update is sent to DLNR each January. These documents are available upon request to others who are interested.

The first section of this plan contains a brief overview of the native resources that are protected at Kanepu‘u Preserve. The second section outlines management considerations that have shaped our programs. Finally, each management program is discussed in turn. Program goals are followed by an explanation of the management method we have chosen and a brief summary of each program’s past accomplishments. Objectives and costs for each program from FY2004 through 2009 are listed.

RESOURCES SUMMARY

General Setting

The formation of Kanepu‘u Preserve was first announced in January 1989 and officially established in November 1991 when Castle and Cooke finalized a perpetual conservation easement with The Nature Conservancy of Hawai‘i (Figure 1). The preserve was created to protect and enhance the olopua/lama (*Nestegis/Diospyros*) dryland forest that once covered large portions of the lowlands on Maui, Moloka‘i, Kaho‘olawe, and Lana‘i. Today, Kanepu‘u contains the last major remnant of this rare dryland forest community.

The climate at Kanepu‘u is relatively dry. Rainfall averages 71 cm (28 in) per year and falls primarily in the rainy season from November through March. Additional moisture comes in the form of fog that condenses on vegetation. Tradewinds are accelerated by funneling between the upwind islands of Moloka‘i and Maui. These strong and nearly constant winds increase evaporation of moisture, vegetation loss, and soil erosion in and around Kanepu‘u. In some places, over 6 feet of soil has been lost. These degraded areas usually have little vegetation and are, therefore, even more susceptible to additional erosion. Many of the eroded areas are characterized by a hard pan substrate that appears unsuitable for plant establishment. Other eroded areas are comprised of dunes of wind-blown soil that may shift with the season.

The preserve is comprised of seven disjunct sections ranging from 13 to 368 acres in size, and totals 590 acres (Figure 2). Major threats to the preserve’s native vegetation are introduced game animals (axis deer and mouflon sheep [*Ovis musimon*]), cattle (*Bos taurus*), rapid soil erosion, wildfire, and a number of invasive alien (non-native) plants. Much of this area was protected from 1911 through 1935 by fencing and other efforts carried out by George Munro, then the ranch manager for the area. Subsequent ranchers removed these fences. From 1970 to 1989, dedicated volunteers and the Hui Malama Pono O Lana‘i built four small fenced exclosures that helped protect patches of native forest and associated rare plants. Without these efforts, the last remnants of this rare Hawaiian forest type would probably have been destroyed.

In 1992, The Nature Conservancy completed construction of a 6’3” tall deer fence around each of the seven patches of forest to prevent further damage by grazing animals. From 1996 through 2001, various sections of fence have been replaced due to severe corrosion from harsh environmental conditions. Fence maintenance, erosion control, and active restoration of specific native species constitute ongoing management activities at the preserve.

Flora and Fauna

Two plant communities dominate Kanepu‘u: the native closed-canopy olopua/lama dryland forest and an alien shrubland. Some sections of the preserve are bordered by a windbreak of non-native trees, including swamp mahogany (*Eucalyptus robusta*), ironwood (*Casuarina* sp.), and Cook pine (*Araucaria* sp.). Areas of bare soil occur throughout the preserve.

The native forest canopy is dominated by approximately 50% olopua (*Nestegis sandwicensis*) and 20% lama (*Diospyros sandwicensis*). The canopy also contains non-native Christmas berry (*Schinus terebinthifolius*) and up to 12 native species including ʻohe makai (*Reynoldsia sandwicensis*), ʻahakea (*Bobea sandwicensis*), ʻalaʻa (*Pouteria sandwicensis*), and ʻaiea (*Nothocestrum latifolium*). The understory has been severely damaged as a result of historical grazing, and contains few remaining native species. Common non-native understory species include lantana (*Lantana camara*), scarlet sage (*Salvia coccinea*), and several grasses including dallis grass (*Paspalum dilatatum*) and molasses grass (*Melinis minutiflora*). Figure 2 shows the current natural communities of the Kanepuʻu unit. (Figures for the other six units of the preserve are available upon request.)

Ten rare plants have been reported in Kanepuʻu; six of these are federally listed as endangered. However, two of these listed species, along with another with no federal status, are known only from historical records and have not been seen at Kanepuʻu since 1930 (Appendix 1). The four endangered plants currently found in the preserve are: the fragrantly flowered *Gardenia brighamii*; sandalwood or ʻiliahi (*Santalum freycinetianum* var. *lanaiense*); the vining *Bonamia menziesii*; and the maʻo hau hele (*Hibiscus brackenridgei* ssp. *brackenridgei*). It should be noted that the maʻo hau hele was planted in the preserve and may not have occurred there naturally.

The following two native birds frequent Kanepuʻu: the pueo (short-eared owl, *Asio flammeus sandwichensis*) and the kolea (Pacific golden-plover, *Pluvialis fulva*). In addition, the endemic ʻamakihi (*Hemignathus virens virens*), ʻapapane (*Himatione sanguinea*), and ʻelepaio (*Chasiempis sandwichensis*) have been observed in Kanepuʻu in recent years. Eleven non-native birds, including introduced game birds, are also found in the preserve's forest and open areas. At least ten different land snail taxa were identified in a subfossil sample found in the preserve. Currently, only the most common native snails still exist in the preserve.

Kanepuʻu Preserve's arthropod fauna was sampled in 1992. According to collection records, 153 different insect species (some unidentified) were found. Nineteen spider taxa, two isopods, and one species of amphipod were also collected. Native taxa include a pyralid moth (genus *Scoparia*), mirids, drosophilids (fruit flies), yellow-faced bees (genus *Hylaeus*), and sphecid wasps. Karl Magnacca (Cornell University) conducted a study of native bees in 2000.

MANAGEMENT

Management Considerations

1. The lands surrounding the preserve are utilized for sustained-yield sport hunting of axis deer and mouflon sheep, and for domestic cattle grazing. The preserve has been fenced to prevent these animals from further damaging native vegetation. Preserve activities must be coordinated with surrounding neighbors, not only for safety reasons, but also to ensure good working relationships.

2. All units of the preserve are accessible by good-quality dirt roads, although four-wheel drive vehicles are needed during wet weather. Unit boundaries, fence lines, and firebreaks are mostly accessible via tractors or other equipment. Access to the preserve is generally obtained through abandoned pineapple field roads, which may move over time. The entire preserve is easily accessible on foot. Mapped corridors that link the seven preserve units were established to satisfy county subdivision requirements and do not represent road access between units.

3. The Lanaʻi community and other members of the public were involved at Kanepuʻu before it was a preserve of The Nature Conservancy. As such, interpretive and other programs offered to the public will continue to encourage their participation in protecting and restoring native species.

4. A central challenge of conservation in Hawaiʻi is to integrate stewardship of native resources with community development, planning, corporate/landowner needs, and the priorities of the grass-roots community. Because of the history of community grass-roots involvement at Kanepuʻu, we initiated a capacity building effort in 1998 with the Hui Malama Pono O Lanaʻi. The goal is to increase their organization effectiveness and develop a solid fundraising track record so that eventually they can become the managers of Kanepuʻu Preserve.

5. Due to past deforestation and grazing by animals, massive wind and rain erosion remains a major threat. Non-native plant species may be utilized to control the erosion in some areas. Wherever possible, however, non-native plants will be replaced with appropriate native species.

6. Because of its accessibility and range of important research opportunities, Kanepuʻu Preserve will be used, to the extent possible, as a focal point for dryland forest restoration studies in Hawaiʻi. Knowledge derived from Kanepuʻu will help protect other dryland areas with similar issues.

7. In December 2002, the State indicated that it will fund the complete replacement of rusted fence in only the Kanepuʻu and Kahue units (the two largest and most intact units). Should other funding become available, the Conservancy may decide to replace the fencing for the other units at a later date.

Management Areas/Units

The preserve is divided into seven units. Kahue unit has the highest diversity of rare plants, and is important for both restoration and interpretation. Kanepu‘u unit has the largest patches of native forest, and is the most important for restoration; interpretation potential here is also great because of its location along a public road. ‘Ahakea unit has a high concentration of rare plants, but the patches of native forest are at either end of the unit, and the smaller patch in the southwest corner is quite degraded. The three Paoma‘i units contain nice patches of forest, but these are quite small. The Mahana unit is separated from the rest of the preserve by the greatest distance and is also biologically the lowest priority for management and restoration.

Management Programs

Although the following management programs are described separately, they form an integrated management approach. For each program listed in the following section, we have indicated a major goal and described the management methods. Included are highlights of past and current achievements, along with key management issues. Finally, objectives and costs for FY2004–FY2009 are listed. Staff time and effort, along with equipment expenses, are included separately within the ‘Personnel, Equipment, and Facilities’ section.

Program 1: Non-native Species Control

A. Ungulate Control

Program Goal

Remove all axis deer from fenced units and maintain their exclusion; continue to exclude mouflon sheep and cattle.

Discussion of Methodology

In September 1992, 9 miles of 6’3” tall deer fence were completed, enclosing each of the seven preserve units. Since fence construction, volunteer hunters have removed more than 340 deer. All units are now deer-free except the Kanepu‘u unit. These hunts, utilizing Lana‘i residents, continue to remove the remaining deer from the Kanepu‘u unit. We work cooperatively with the state Division of Forestry and Wildlife and Division of Conservation and Resources Enforcement on all aspects of our ungulate control program (Wildlife Control Permit WCM 03-08). Mouflon sheep, which are increasing in number on Läna‘i, and cattle, which previously wandered into some of the preserve units, are now fenced out. There are no feral pigs or goats on the island of Lana‘i.

Over the past ten years, we have noted the increasing presence of native tree seedlings of many species (previously deer had eaten seedlings). Moreover, mature trees, formerly stripped of leaves and branches to the height a deer can reach, are now re-sprouting from the base.

Initially, erosion problems caused by heavy rains were the focus of fence maintenance efforts. A culvert was constructed in one area, and a ditch dug to channel water away from the fenceline in another. In 1995 and 1996, aprons were constructed to repair areas where fence posts had been

lifted out of the ground and caused the bottom wire to rise (in some cases 1 to 2 feet). Additionally, fence wire corrosion accelerated significantly in 1996. Wind during the dry years, along with heavy rains during winter 2001–02, has caused more major erosion. Wattles have been placed along the bottom of the Kahue fence and a contractor has removed some sand dunes that had buried the fence to within three feet of the top of the posts. In other places, wind erosion has caused the posts to almost fall over.

The last long-range management plan for Kanepu‘u Preserve included annual fence maintenance and replacement; however, for the initial years of that plan, very little replacement was needed. We have learned that once the galvanizing on the current 12.5 gauge wire becomes noticeably corroded (rusted looking), the wire fails quickly (i.e. within about 6 months). Salt spray, carried 3 miles inland and up to Kanepu‘u Preserve's 1,700-foot elevation, seems to be the largest corrosive factor. Professional fence builders and natural area managers surmise that the dry environs of Kanepu‘u, exacerbated by the drought of the past few years, has allowed salt spray to stick to the wire rather than being washed clean by rains. Only where a tall shrub, tree, or fence post protects wire from the salt spray is corrosion minimal or non-existent. The corrosion appears accelerated where the fence is downwind from an unvegetated area; this is probably due to soil particles constantly battering the fence. While we considered re-vegetation as part of the fence protection program, it appears that only tall vegetation will protect the fence, and this poses other problems to fence maintenance.

From October 1996 through June 2002, fencing was replaced for all of Kahue and much of Kanepu‘u. Fences at Paoma‘i 1, Paoma‘i 2, and Upper Paoma‘i were also completely replaced, as were major sections of ‘Ahakea and Mahana. During these replacements, a fence materials test was completed to determine the most durable materials that could be used in the preserve. Costs for the materials and installation were also assessed. Results indicate that the best solution to the fence deterioration problem is to use stainless steel fence. This type of stainless wire is used successfully in New Zealand on deer farms. Other materials were unsuitable. Although stainless wire is more expensive than the Bezinal or galvanized fencing, it should prove less costly in the long run.

Initially, in an earlier draft of this plan, we had asked the State for NAPP funds to fence the remaining units with stainless steel wire. Unfortunately, the cost of replacing corroded fences with stainless wire represented a significant increase in the proposed budget compared to previous years and hindered the State's ability to fund the protection of higher quality dry forests elsewhere. Consequently, per the suggestion of the Natural Area Reserves System's Commissioners, we have prioritized areas to fence with stainless steel wire in order to scale back our initial funding request. Herein we are no longer requesting NAPP funds for stainless wire for five units: Paoma‘i 1, Paoma‘i 2, Upper Paoma‘i, ‘Ahakea and Mahana. However, we reserve the right to fence these units with stainless steel wire should grant funds from other sources become available (e.g. federal or private grants).

Activities

Year 1 (FY2004)
- Replace wire around the south side of Kanepu‘u unit with stainless steel.
- Repair wire where damaged in selected units; reroute water to prevent erosion.
- Maintain zero ungulate levels in fenced units.

Contractual (fence materials, supplies, and labor)	$64,000

Year 2 (FY2005)
- Repair wire where damaged in selected units; reroute water to prevent erosion.
- Maintain zero ungulate levels in fenced units.

Fence materials and supplies (annually)	$1,000

Year 3 (FY2006)
- Repair wire where damaged in selected units; reroute water to prevent erosion.
- Maintain zero ungulate levels in fenced units.

Fence materials and supplies (annually)	$1,000

Years 4-6 (FY2007-09)
- Repair wire where damaged in selected units; reroute water to prevent erosion.
- Maintain zero ungulate levels in fenced units.

Fence materials and supplies (annually)	$1,000

B. Weed Control

Program Goal
Prevent the further displacement of native vegetation by non-native plants and, where possible, reduce and eradicate weed populations.

Discussion of Methodology
With the removal of ungulates from the majority of the preserve, weed control has become the most labor-intensive program at Kanepu‘u. A number of non-native plants are well established in the preserve. We have narrowed our focus to controlling habitat-modifying weeds (Table 1) in Special Ecological Areas within the fenced units. SEAs are areas of high quality dry forest. Our strategy has been, and continues to be, removal of canopy-dominant species in the most intact native forest areas, removal of incipient weeds preserve-wide, and lastly, removal of additional habitat-modifying weeds from wider areas in the preserve. Weed control is accomplished manually, with limited use of herbicides. In 2000, we began to fill in gaps created in the native forest as a result of weed removal by planting native species.

Another aspect of our weed control program is prevention. Education about potentially harmful weed introductions is having a large impact on Lana‘i because of its small resident population, lack of commercial nurseries, and limited visitor accommodations. Removal of incipient populations of potentially harmful weeds found outside the preserve has been accomplished by working with the new conservation manager from the island's largest nursery and landscaper, Castle & Cooke Resorts, and with participants of project stewardship and outreach programs.

In the past ten years, we have concentrated on the removal and/or girdling (total removal can let in too much light) of canopy-dominating weeds, primarily *Schinus terebinthifolius* (Christmas berry), from the most intact forest patches. Removal of weeds needs to be done systematically and in tandem with restoration and replanting efforts to prevent further erosion of bare soil. Monitoring and re-treating re-growth remains a growing part of the weed control effort. *Passiflora suberosa* (huehue haole or corky passion vine) was not documented in the preserve until 1995; however, we know it is not a new pest because it is widespread and resprouting vines are quite large. It was likely suppressed by deer. This vine is a major concern because it has become a major pest in other dry forests in Hawai‘i. We are also concentrating on an incipient population of the balloon plant (*Asclepias physocarpa*), which likely arrived with cattle feed. We continue to monitor an incipient patch of fountain grass (*Pennisetum setaceum*) that was found outside the north boundary fence of Kanepu‘u unit in 1998. It was treated by DOFAW staff and appears to be eradicated.

We will continue to employ a combination of manual and chemical control methods, using non-restricted use herbicides. Those being considered for use include Garlon 3A, Garlon 4, Round-up, and one or more grass-specific herbicides. Herbicides will generally be applied using solutions painted or dripped directly on cut stumps or in frill cuts. In the case of Christmas berry, it was found that painting Garlon on the stumps or cuts actually encouraged resprouting from the roots. Localized spraying of grasses with a backpack sprayer may be employed on non-windy days. Until significant numbers of native plants can be obtained to fill in the gaps, we will not remove all canopy dominating weeds.

Table 1: Priority Weed Species in Kanepu‘u

Scientific Name	Common Name
Acacia confusa	Formosan koa
Acacia farnesiana	Klu
Asclepias physocarpa	Balloon plant
Casuarina sp.	Ironwood
Grevillea robusta	Silk oak
Lantana camara	Lantana
Leucaena leucocephala	Koa haole
Melinis minutiflora	Molasses grass
Panicum maximum	Guinea grass
Passiflora suberosa	Huehue haole
Psidium cattleianum	Strawberry guava
Psidium guajava	Guava
Schinus terebinthifolius	Christmas berry

Activities

Years 1-6 (FY2004-09)

- Girdle/remove Christmas berry from intact native forest patches in Kahue.
- Perform follow-up treatment of previously treated weeds.
- Conduct weed control and removal as documented in the Restoration Plan.
- Assist with removal of potentially harmful incipient weeds found outside the preserve.
- Expand planting of native species in conjunction with weed control.

Supplies (annually)	$1,000

C. Small Mammal Control

Program Goal

Prevent small mammals from damaging rare native species and limit their impact on the preserve's native biota.

Discussion of Methodology

Our current small mammal control program focuses on controlling rats and mice with diphacinone bait blocks in bait boxes. The mongoose is not currently established on Lanaʻi.
If we observe other small mammals (feral rabbits, feral cats) posing a threat to native species, we will establish a trapping program (since diphacinone is not registered for use with these mammals).

Diphacinone is registered for use in natural areas in Hawaiʻi under a Section 24c registration (also known as a special local needs registration) under the Federal Insecticide Fungicide and Rodenticide Act. All diphacinone use at Kanepuʻu is in accordance with the special local needs registration. Bait is deployed in Protecta brand tamper-proof boxes. The state Department of Agriculture is tracking diphacinone use in Hawaiʻi and requires annual notification of use. Bait is limited to 16 ounces per station. All areas baited are posted in accordance with requirements. If approved for use in Hawaiian natural areas, we may also deploy other types of rodenticides that are shown to be safe and effective.

An assessment of the rat population of Kanepuʻu was conducted in January 1995. The results of this assessment included a recommendation to use bait stations in 50-meter grids around rare plant populations. U.S. Fish and Wildlife recovery plans for both *Gardenia brighamii* and *Santalum freycinetianum* var. *lanaiense* state that rodent control efforts should be implemented for these species at Kanepuʻu. Both species usually contain fruit year-round. Other rare plant taxa, such as *Bonamia menziesii* and *Reynoldsia sandwicensis*, also benefit from rodent control during fruiting stages. The stations established in 1996 remain distributed to protect these rare plants (Table 2).

In 1997, the number of bait stations was increased from 28 to 46. We also determined optimal re-baiting intervals in 1997, with the minimum interval remaining at one month. Since 1998, there

has been virtually no sign of rats in the preserve, most likely due to the excessively dry conditions caused by drought. Since rain has returned in November 2002, we continue to check bait stations on a monthly basis.

TABLE 2: Locations of Rodent Bait Stations in Kanepu‘u Preserve

Location	# of Stations	Frequency	Purpose
Kanepu‘u unit			
Lapaiki	4	Year-round	Protect rare plant cluster
Little Kanepu‘u	4	Year-round	Protect rare plant cluster
Kahue unit			
Kahue exclosure, extending outside	9	Year-round	Protect rare plant cluster
Reynoldsia	4	Seasonal, to coincide with fruiting	General control
Paoma‘i units			
Reynoldsia patches	~10	Seasonal, to coincide with fruiting	General control
Upper Paoma‘i intact forest patch	4	Year-round	General control
‘Ahakea unit			
Exclosure	4	Year-round	Protect rare plant cluster
Gardenia	4	Once	Tree has not fruited in six years

Activities

Years 1-6 (FY2004-09)

- Maintain existing stations on schedule (listed in Table 2), with a strong focus on Kanepu‘u and Kahue units, to protect seeds and seedlings of native plants.
- Track established bait stations and report.

Supplies (annually) $500

Program 2: Fire Control

Program Goal

Prevent all wildfires in the preserve.

Discussion of Methodology

Wildfire is a major threat and has diminished the extent of native vegetation in the preserve in the past. Vehicle traffic along roads passing through or near the preserve is the primary source of ignition. Nevertheless, the Conservancy is required to accommodate public access through the preserve along these or suitable alternate roads. A 15 – 20 foot wide swath of cleared vegetation along the fenceline of each preserve unit will be maintained as a fuel break for fire prevention. All full-time staff will participate in fire training offered by state or federal partner agencies. Costs

associated with travel and lodging for such training are included under Personnel, Equipment, and Facilities.

Staff have prepared a fire management plan for Kanepu‘u Preserve, and will update the plan annually to reflect advances in our fire pre-suppression activities. We work with the Division of Forestry and Wildlife (DOFAW) and Maui County for fire suppression at Kanepu‘u Preserve, and meet with DOFAW and county fire personnel on Lana‘i annually to discuss our fire management plan and address fire-related issues.

Years 1-3 (FY2004-06)
- Maintain fuel breaks.
- Meet with County and DOFAW fire staff to discuss fire preparedness.

Professional fees – mowing service (annually)	$1,000

Year 4 (FY2007)
- Maintain fuel breaks; grade along fence as needed to accommodate mower.
- Update fire and safety tools.
- Meet with County and DOFAW fire staff to discuss fire preparedness.

Professional fees – mowing service and grading	$1,500
Supplies – fire and safety tools	750
Subtotal	$2,250

Years 5-6 (FY2008-09)
- Maintain fuel breaks.
- Meet with County and DOFAW fire staff to discuss fire preparedness.

Professional fees – mowing service (annually)	$1,000

Program 3: Restoration, Research and Monitoring

A. Restoration

Program Goal
Create a naturally regenerating olopua/lama dryland forest in defined SEAs (Special Ecological Areas) and expand the current range of native-dominated vegetation through key stewardship activities. Document the successes and failures of our restoration work for application to other dryland areas of Hawai‘i.

Discussion of Methodology
Threat control programs at Kanepu‘u Preserve should slow the loss of native forest, but active vegetation manipulation is needed to ensure expansion and eventual self-perpetuation of the forest and its associated rare plants. Because of its accessibility and broad range of restoration

problems, we envision Kanepu‘u becoming an important study site for testing and refining restoration techniques and communicating these to a broader audience. Restoration of tropical dryland systems is a relatively new endeavor for Hawai‘i's resource managers, and we will collaborate wherever possible to exchange information with other agencies and individuals.

In 1997, we constructed a nursery on Lana‘i to enhance propagation efforts and to minimize contamination of seedling containers with weed and insect pests. We have conducted trials on germination techniques for various species including olopua (*Nestegis sandwicensis*), lama (*Diospyros sandwicensis*), ‘iliahi (*Santalum freycinetianum* var. *lanaiense*, ala‘a (*Pouteria sandwicensis*), keahi (*Nesoluma polynesicum*), ‘ohe makai (*Reynoldsia sandwicensis*), naio (*Myoporum sandwicense*), gardenia (*Gardenia brighamii)*, ko‘oloa ‘ula (*Abutilon menziesii*), loulu (*Pritchardia lanaiensis*), ma‘o hau hele (*Hibiscus brackenridgei* subsp. *brackenridgei*), halapepe (*Pleomele fernaldii*), alahe‘e (*Psydrax odoratum*), maiapilo (*Capparis sandwichiana*), ‘akoko (*Euphorbia skottsbergii*), *Bonamia menziesii*, and mamane (*Sophora chrysophylla*). We will continue to work with cooperating nurseries on other islands to ensure an adequate supply of seedlings for ongoing restoration trials and plantings. All species germination rates are in the range of 85 to 95% with the exception of olopua (the viability of seeds varies greatly from tree to tree) which can vary from 10 to 80%. Loulu germination averaged about 69%.

Another effort covered under this program is rare plant outplanting. Our immediate priority is to augment Kanepu‘u’s existing populations, beginning with the most rare species. Work on propagating *Gardenia brighamii* and *Santalum freycinetianum* var. *lanaiense* started in 1997. We have had success with both species, although we have greater numbers of *Gardenia* since it is both easy to grow and produces larger numbers of seeds. We average a germination rate of about 70 to 85% for the *Santalum* although some trees produce more viable seeds than others. The rate for the *Gardenia* is approximately 87 to 95%.

Because mongooses have not been introduced to Lana‘i, the island is a good candidate location for reintroduction of native ground-nesting birds. In 1996 we conducted a site assessment with state wildlife staff for reintroduction of the Hawaiian goose (nene, *Branta sandvicensis*). Habitat in the preserve was not deemed suitable for reintroduction of nene, and so we are not pursuing reintroduction at this time.

Activities

Years 1-6 (FY2004-09)

- Guided by revised restoration plan, continue collecting seeds; propagate at TNCH nursery, work with cooperative nurseries to propagate off-site, and implement appropriate monitoring of restoration areas.
- Expand restoration work, including site identification and preparation, planting, maintenance, and monitoring.
- Maintain established restoration sites and collect data annually.

Materials and supplies (annually)	$1,000

B. Research and Resource Monitoring

Program Goal

Track the preserve's biological and physical resources and evaluate changes in these resources over time.

Discussion of Methodology

Monitoring of preserve vegetation was conducted in 1993. The monitoring methods were designed to gather data comparable to vegetation measures (taken in Kanepu'u unit) reported in a 1976 article in the Hawaiian Botanical Society newsletter by Spence and Montgomery. These methods were clarified and refined in 1997. Vegetation monitoring is scheduled to be repeated in 2007. The purpose of vegetation monitoring is to assess native and alien vegetation in areas of native-dominated dry forest. Native-dominated is defined in this plan as patches of forest with greater than 50% native foliar canopy cover. Vegetation monitoring is not designed to track populations of rare or endangered species; instead, rare species monitoring is conducted separately on an annual basis. Vegetation monitoring is used to evaluate the overall viability and species composition of the Olopua/Lama Lowland Dry Forest natural community within fenced units of Kanepu'u Preserve. Various parameters are monitored and used as indicators to determine both the short-term and the long-term effectiveness of management actions, such as weed removal and deer control, on the integrity of the native dry forest ecosystem.

In 1998, the Hawai'i Natural Heritage Program conducted vegetation mapping using aerial photos and ground truthing using global positioning system (GPS) equipment. In addition to the vegetation maps, the Hawai'i National Heritage Program also mapped endangered plant locations and features such as vegetation monitoring plots, trails, and restoration plots. In 2000, the GIS maps were redone to correct errors and expand coverage to areas outside the fence lines. The latest available infrared photos were from 1990. These were digitized and new ground data were collected with the help of a college student volunteer. Boundaries of different vegetation types and eroded areas have been digitized for all units except Mahana and Kanepu'u. Areas surrounding the five central units have also been digitized. Although mapping has been conducted, newer photographs are needed to show changes in the vegetation that have occurred since 1990.

TNCH compiles a list of priority research topics dealing with management issues. (It is posted at the University of Hawai'i's EECB web site.) Several topics on the list are pertinent to work at Kanepu'u. These include studies on: the reproductive biology of dry forest plants; dry forest natural community composition; the feasibility of weed control by grazing animals; the mechanisms for weed dispersal into this highly fragmented preserve; the role of introduced alien invertebrates; techniques for erosion control and restoration ecology; and the role of cloud interception and fog drip as a water source for dry forests. Despite these tantalizing topics, researchers are reluctant to work on Lana'i due to the expenses associated with logistics (interisland airfare, lack of affordable accommodations and vehicle rentals). Realizing the difficulty and expense associated with working on Lana'i, we occasionally provide researchers with financial assistance for travel and lodging, on a case by case basis.

Activities

Years 1-6 (FY2004-09)

- Perform annual rare plant monitoring.
- Perform vegetation monitoring in FY07.
- Work with researchers to initiate or continue research at Kanepu‘u Preserve; provide logistical assistance to researchers.

Miscellaneous – research/logistical support (annually)	$1,500

Program 4: Community Outreach

Program Goal

Foster community awareness of natural resource and restoration issues in Hawai‘i, especially those unique to Kanepu‘u Preserve. Attain preserve management goals with the assistance of volunteers.

Discussion of Methodology

Volunteers saved the last remnants of forest at Kanepu‘u over the past several decades, and they will continue to be a key component of the preserve’s programs. Hui Malama Pono O Lana‘i is the primary group on Lana‘i involved with Kanepu‘u and preservation of the islands cultural, biological, and historical sites. We will continue to involve members of the Hui, and a variety of school and community groups and individuals in undertaking this long-range management plan. We have established a campsite and maintain necessary camping equipment for volunteer groups to use in the Kanepu‘u unit.

Our interpretive program was developed with guidance from members of the Hui and staff of Castle & Cooke. The current program includes a self-guided interpretive trail in the Kanepu‘u unit, and a trail in the Kahue unit open only to visitors accompanied by staff or a trained hike leader (docent). The largest group that annually visits the preserve is the student body of Lana‘i High and Elementary School, some 300 children plus 70 parent and teacher chaperones. While we believe guided visits are the best way to share the preserve’s story, a public road traverses the Kanepu‘u unit so people must travel through the preserve going to points northwest. This provides an opportunity to expose more individuals to the preserve.

A short, 750-meter self-guided trail was established in the Kanepu‘u unit in 1997 to allow for unguided visitation along the main (unpaved) Polihua Road. The trail makes a quick visit possible, and will improve the community’s understanding of the preserve’s resources. The brief trail signs were designed to match the existing interpretive signs on the island at the request of Castle & Cooke and the Hui to ensure a feeling of continuity with other important island sites. In discussions about the self-guided trail with the Hui, concerns were raised about abuse of the trail and preserve resources through unguided use (particularly the threat of taking native trees to use in woodworking). We agreed to watch for impacts on the trail and the surrounding area (mostly lantana-dominated, a deterrent to wandering off the trail). If we see evidence of such abuse, we

will take measures to prevent it in the future, and will remove the signs and halt use of the trail if necessary. To date no evidence of abuse has been seen. We have discussed lengthening the trail with members of the Hui so that it shows more of the native vegetation. See Appendix 3 for further details on trail use.

With the help of TNCH's Project Stewardship Expansion Coordinator and a Lanaʻi High and Elementary School teacher, a pilot Project Stewardship Program was initiated in Spring 2002. The school's environmental science class and their teacher conducted classroom activities along with monthly hands-on field trips at Kanepuʻu Preserve. During these field trips, students worked closely with TNCH Lanaʻi staff to actively care for a designated restoration site in Kanepuʻu Preserve (specifically in KH-R2). Project Stewardship makes learning about science and the environment real, giving students hands-on opportunities to make a difference while, at the same time, building a sense of community. Our hope is that teachers and students involved in Project Stewardship will share their experiences and knowledge with others in the school and family environment, thus expanding the impact of the program. With the continued support from Lanaʻi High and Elementary School and Hui Malama Pono O Lanaʻi, we plan to continue Project Stewardship every year.

Because Lanaʻi has a small population (fewer than 3,000 residents), and because of the community's history of involvement in Kanepuʻu, Lanaʻi poses a unique opportunity to educate the majority of residents to issues related to the conservation of Hawaiʻi native natural resources. In our last long-range management plan we indicated that we planned to engage the Lanaʻi community in natural resources protection in ways beyond the simple labor and education programs we have conducted in the past. We began to implement this new phase of our community outreach program by obtaining private grant funds to conduct a series biodiversity planning workshops as well as to hire consultants to conduct focused capacity building with the Hui Malama Pono O Lanaʻi.

The Hui held its first official annual meeting in December 1999. In 2001, TNCH sponsored three training workshops for the community, led by Joe Lapilio of the Hawaiʻi Community Services Council. These management-based workshops focused on development of an effective board, human resource issues, strategic planning ideas, community relation plans, and fundraising opportunities. After these meetings, the Hui hired their first paid staff member (a half-time coordinator). A Memorandum of Understanding was signed in March 2001. Building on these beginning steps, we will continue to enhance the capacity of the Hui in the next six years to assist with management at Kanepuʻu Preserve. TNC will provide occasional training, along with ensuring that the biological goals of the long-range management plan are met.

Activities

Years 1-6 (FY2004-09)

- Continue to build the capacity of an island-based community group to develop its capacity to assist with the management of the preserve.
- Continue to develop a community outreach program to increase awareness of natural resources in Hawai‘i and the threats they face.
- Organize volunteer trips for both Lana‘i and off-island groups.
- Monitor use and impacts on self-guided interpretive trail in Kanepu‘u unit.
- Conduct new and refresher training for docents, and promote guided hike opportunity to Lana‘i and off-island groups.
- Continue Project Stewardship with Lana‘i High and Elementary School and Hui Malama Pono O Lana‘i.

Supplies – volunteer support (annually)	$1,500

Program 5: Watershed Partnerships

On October 11, 2001 a Memorandum of Agreement was signed, bringing together the following entities into a Lana‘i Forest and Watershed Partnership: Castle & Cooke Resorts LLC (formerly known as Lana‘i Company Inc.), Hui Malama Pono O Lana‘i, Maui County Board of Water Supply, State of Hawai‘i Department of Land and Natural Resources Division of Forestry and Wildlife, U.S. Fish and Wildlife Service, The Nature Conservancy, the United States Department of Agriculture Natural Resources Conservation Service, Moloka‘i-Lana‘i Soil and Water Conservation District, Lana‘i Water Advisory Committee, State of Hawai‘i Commission on Water Resource Management, and Maui County. During the next six years, we plan to coordinate quarterly meetings and work with landowners to educate them on the importance of watershed regions in Hawai‘i, along with providing staff support to assist with watershed protection activities.

Program 6: Personnel, Equipment, and Facilities

Program Goal
Maintain staff and facilities required to implement the goals of The Nature Conservancy on Lana‘i in a safe, productive environment.

Discussion of Methodology
A team led by the Kanepu‘u Natural Resource Manager (NRM) manages Kanepu‘u Preserve. The NRM (100% FTE) is currently supervised by TNCH’s Landscape Partnership Director (not funded through NAPP). The Kanepu‘u team also includes one full-time Field Technician (100% FTE) and a Program Assistant (10% FTE). These are the three positions funded under "salaries and fringe" in the budget below. Our Americorp volunteers provide additional field support. Due

to budgetary constraints were are no longer able to fund the summer internship program. The Natural Resources Manager (NRM) plans and oversees the implementation of priority threat abatement and management activities, which includes alien animal and plant control, research, resource monitoring, and habitat restoration. The NRM also leads or guides the development of long-range, annual, and specific management/conservation plans and budgets, negotiating and managing contracts to accomplish preserve objectives under the supervision of a program manager. The Field Technician is responsible for implementing threat control, assists with restoration activities, and plans and coordinates school and community outreach activities. The Program Assistant helps with purchasing, reporting, and community outreach activities.

We expect that by FY05, approximately 30% of staff time focused on threat control programs (weeds and ungulates); 30% on restoration, research, and resource monitoring; 20% on community outreach; 10% on planning and administration; and 10% on watershed partnership activities. If necessary, the current supervisory and staffing structure may be modified to improve effectiveness. For example, in keeping with the trend of community-based conservation, we may choose to hire a Lana‘i-based director during the next six years to oversee the Kanepu‘u program. We also are moving toward closer planning and cooperation with Lana‘i's Forest and Watershed Partnership.

All full-time staff is provided training in first aid, CPR and fire suppression. Field staff participate in a variety of emergency and safety training programs offered by cooperating state and federal agencies (fire training, helicopter safety, hunter safety, rappelling, etc.). Other training needs, such as computer, communication and other skill building courses, are provided to staff on an individual, as needed basis.

Travel costs consist of inter-island transportation for TNCH staff, as well as for occasional trips to the mainland for workshops and conferences. Facilities costs incurred to support the Kanepu‘u Preserve program include a baseyard, a small office for preserve staff (located in the old Dole Administration building), and a greenhouse at the Lana‘i Company nursery (included in the ‘Restoration’ program budget). Supplies include the cost of fuel, insurance, and maintenance for two vehicles; in FY05, we will consider the need to purchase or lease a new vehicle. Maintenance for other field equipment includes a chipper and power tools; in addition, general supplies and equipment are also needed to perform overall management activities.

The Nature Conservancy’s Honolulu office provides administrative, technical and annual planning support. In particular, the Coordinator of Landscape Conservation, the Ecologist, and other resource staff will help prepare annual plans and reports and develop and implement monitoring and research programs.

Activities

Year 1 (FY2004)	
Salaries and fringe	$89,859
Travel	5,000
Facilities	9,000
Supplies/Equipment	9,000
Training	1,000
Subtotal	$113,859
Year 2 (FY2005)	
Salaries and fringe	$93,004
Travel	5,000
Facilities	9,000
Supplies/Equipment	9,000
Training	1,000
Subtotal	$117,004
Year 3 (FY2006)	
Salaries and fringe	$96,259
Travel	5,000
Facilities	9,000
Supplies/Equipment	9,000
Training	1,000
Subtotal	$120,259
Year 4 (FY2007)	
Salaries and fringe	$99,628
Travel	5,000
Facilities	9,000
Supplies/Equipment	9,000
Training	1,000
Subtotal	$123,628
Year 5 (FY2008)	
Salaries and fringe	$103,115
Travel	5,000
Facilities	9,000
Supplies/Equipment	9,000
Training	1,000
Subtotal	$127,115

Year 6 (FY2009)

Salaries and fringe	$106,724
Travel	5,000
Facilities	9,000
Supplies/Equipment	9,000
Training	1,000
Subtotal	$130,724

BUDGET SUMMARY

The following tables summarize the 6-year budget for Kanepu‘u Preserve. Through the NAP program, the State of Hawai‘i will fund two-thirds of the costs outlined in this Long-Range Management Plan. Recognizing that the NAPP budget is not expected to increase significantly in the coming years, we have not included routine, annual increases for most of the program activities described above. In addition, little provision has been made for possible future inflation or general cost increases, other than a 3% annual increase for salaries and fringe benefits. If significant cost increases occur over the course of this Plan, we may need to work with DLNR to revise goals or seek additional NAPP funds through an amended plan.

An overhead charge is included to recognize the administrative support provided by TNC; although TNC’s current negotiated rate with the federal government is 25%, a maximum of 10% is allowable by the NAP Program. Thus, TNCH will absorb the 15% in indirect differential, as well as any future increases to or other changes in the overhead rate.

	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	Total
Non-Native Species Control:							
Ungulate Control	64,000	1,000	1,000	1,000	1,000	1,000	69,000
Weed Control	1,000	1,000	1,000	1,000	1,000	1,000	6,000
Small Mammal Control	500	500	500	500	500	500	3,000
Fire Control	1,000	1,000	1,000	2,250	1,000	1,000	7,250
Restoration, Research & Monitoring:							
Restoration	1,000	1,000	1,000	1,000	1,000	1,000	6,000
Research & Monitoring	1,500	1,500	1,500	1,500	1,500	1,500	9,000
Community Outreach	1,500	1,500	1,500	1,500	1,500	1,500	9,000
Watershed Partnerships	0	0	0	0	0	0	0
Personnel, Equip. & Facilities	113,859	117,004	120,259	123,628	127,115	130,724	732,589
Subtotal	**184,359**	**124,504**	**127,759**	**132,378**	**134,615**	**138,224**	**841,839**
Overhead (10%)	18,436	12,450	12,776	13,238	13,462	13,822	84,184
TOTAL	**202,795**	**136,954**	**140,535**	**145,616**	**148,077**	**152,046**	**926,023**

	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	Total
Kanepu‘u Budget	**202,795**	**136,954**	**140,535**	**145,616**	**148,077**	**152,046**	**926,023**
Match (1/3)	67,598	45,651	46,845	48,539	49,359	50,682	308,674
NAPP Request (2/3)	**135,197**	**91,303**	**93,690**	**97,077**	**98,718**	**101,364**	**617,349**

ENVIRONMENTAL REVIEW COMPLIANCE

All actions being proposed for reauthorization in this Long-Range Management Plan are substantially similar to, and relevant to, the actions previously considered in the *Final Environmental Assessment of Kanepu‘u* for which we received a "Finding of No Significant Impact" in 1997. Pursuant to Hawai‘i Administrative Rule 11-200-13 (*Consideration of previous determination and accepted statements*), all environmental review obligations under the Hawai‘i Revised Statutes (Ch. 343) have been fulfilled and are in keeping with the letter and intent of the administrative rules regulating the Natural Area Partnership Program (HAR 13-210).

Figure 1

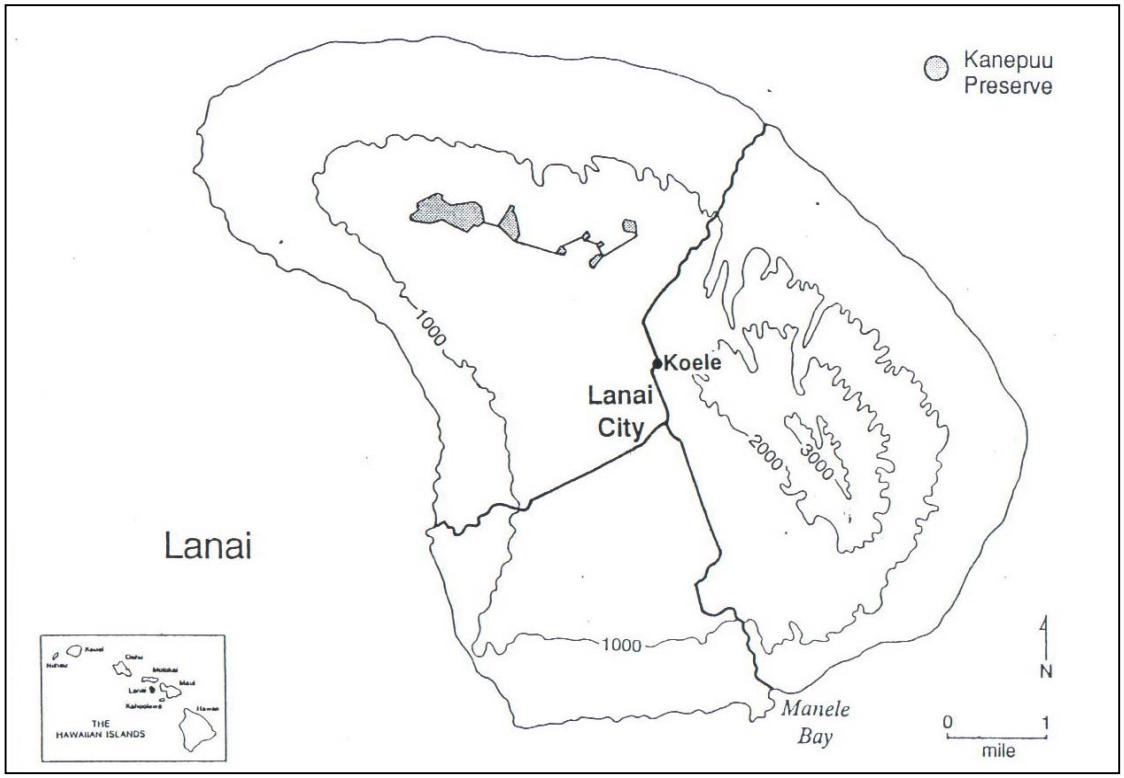
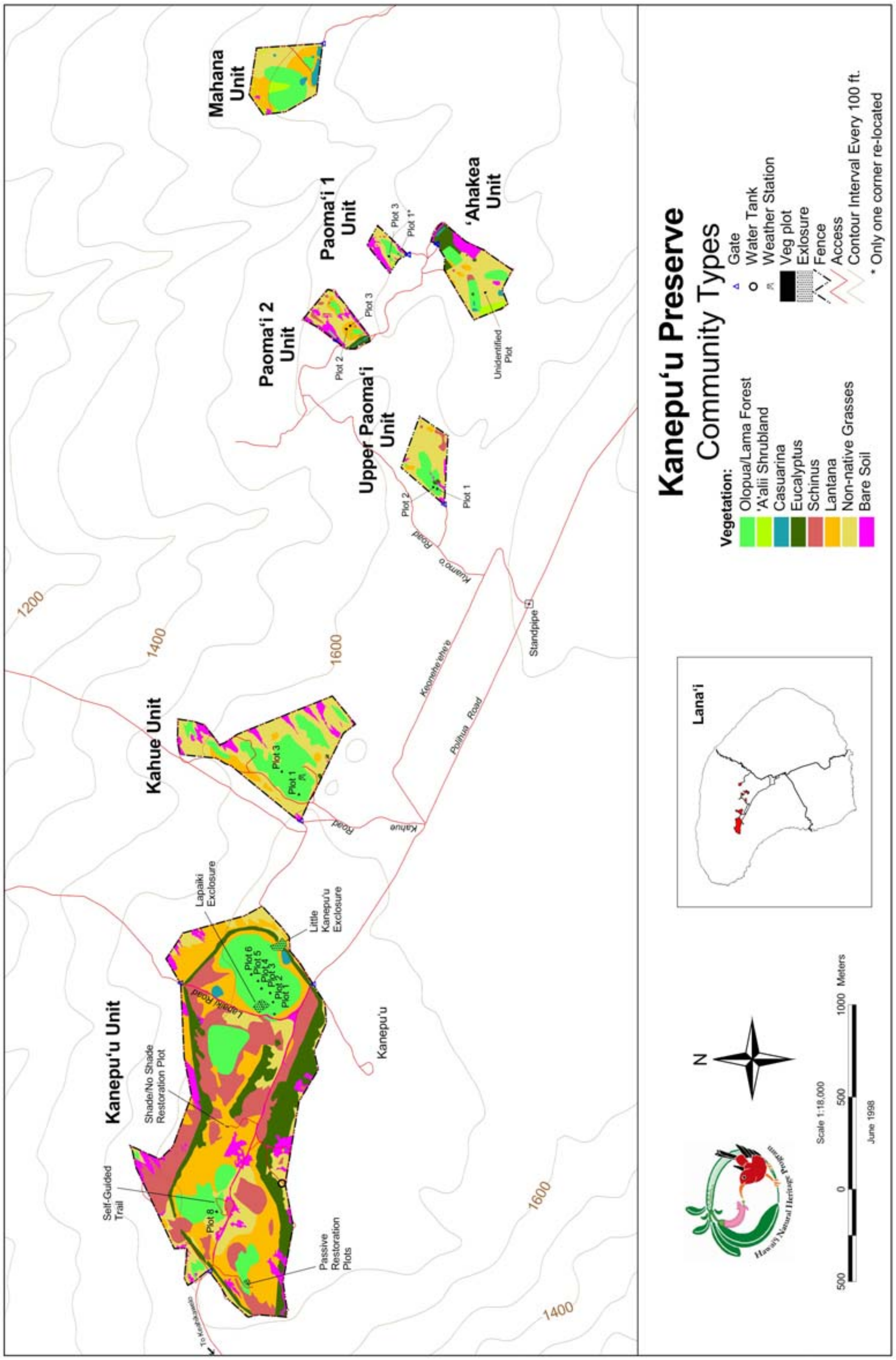

Kanepuu
Preserve
1000
Koele
Lanai
City
2000
3000
Lanai
1000
N
Manele
Bay
0
1
mile
THE
HAWAIIAN ISLANDS

Figure 2


Kanepu'u Preserve
Community Types
Vegetation:
Olopua/Lama Forest
'A'alii Shrubland
Casuarina
Eucalyptus
Schinus
Lantana
Non-native Grasses
Bare Soil
Gate
Water Tank
Weather Station
Veg plot
Exclosure
Fence
Access
Contour Interval Every 100 ft.
* Only one corner re-located
Lana'i
Scale 1:18,000
June 1998
500 0 500 1000 Meters
N
Kanepu'u Unit
Kahue Unit
Upper Paoma'i Unit
Paoma'i 2 Unit
Paoma'i 1 Unit
'Ahakea Unit
Mahana Unit
Lapaiki Exclosure
Little Kanepu'u Exclosure
Shade/No Shade Restoration Plot
Self-Guided Trail
Passive Restoration Plots
Unidentified Plot
Standpipe
Kanepu'u
Kahue Road
Polihua Road
Keomuku Road
Kuamo'o Road
1200
1400
1600

APPENDIX 1
RARE PLANTS OF KANEPU‘U PRESERVE

SCIENTIFIC NAME	COMMON NAME	HERITAGE RANK (a)	FEDERAL STATUS (b)
Bidens micrantha ssp. *kalealaha**	Ko‘oko‘olau	G3?T1	LE
Bobea sandwicensis	‘Ahakea	G2	—
Bonamia menziesii		G2	LE
Gardenia brighamii	Na‘u	G1	LE
*Haplostachys munroi**		GH	—
Hibiscus brackenridgei ssp. *brackenridgei*[1]	Ma‘o hau hele	G1T1	LE
Nesoluma polynesicum	Keahi	G2	—
Nothocestrum latifolium	‘Aiea	G1	—
Santalum freycinetianum var. *lanaiense*	‘Iliahi	G3T2	LE
*Vigna o-wahuensis**		G1	LE

* Plants known historically from preserve
[1] Planted in the preserve; not historically known from area

(a) Heritage Rank:
G1=Species critically imperiled globally (typically 1–5 current occurrences).
G2=Species imperiled globally (typically 6–20 current occurrences).
G3=Species very rare and local (typically 21–100 current occurrences).
GH=No known observations in the past 15 years.
G?=Rank tentative, more information needed to confirm.
T1=Subspecies or variety critically imperiled globally.
T2=Subspecies or variety imperiled globally (typically 6–20 current occurrences).

(b) Federal Status:
LE=Listed endangered.

APPENDIX 2
DOCUMENTS RELATED TO KANEPU‘U PRESERVE

Management Plans

Bornhorst, Heidi, Patrick Dunn, and Dwight Matsuwaki. 1991. *Easement Documentation Report - Kanepu‘u Preserve - Island of Lana‘i - Maui County, Hawai‘i*. The Nature Conservancy of Hawai‘i. Honolulu, HI.

Holt, Alan. 1990. *Kanepu‘u Preserve, Lana‘i. 1991 Start-up Plan*. The Nature Conservancy of Hawai‘i. Honolulu, HI. Unpublished report.

The Nature Conservancy of Hawai‘i. 1998. Wildfire Management Plan. Kanepu‘u Preserve, Lana‘i. The Nature Conservancy of Hawai‘i. Honolulu, HI. June 1998.

The Nature Conservancy of Hawai‘i. 1991. *Kanepu‘u Preserve, Lana‘i, Hawai‘i. Long-Range Management Plan, Fiscal years 1992 – 1997.* Unpublished document prepared for the Department of Land and Natural Resources Natural Area Partnership Program.

The Nature Conservancy of Hawai‘i. 1993. *Kanepu‘u Preserve, Lana‘i, Hawai‘i. Long-Range Management Plan. Fiscal Years 1994-1999.* The Nature Conservancy of Hawai‘i. Honolulu, HI. Revised March 1993.

The Nature Conservancy of Hawai‘i. 1993. *Summary of Changes. Kanepu‘u Preserve, Lana‘i, Hawai‘i. Long-Range Management Plan.* Unpublished document prepared for the Department of Land and Natural Resources Natural Area Partnership Program.

The Nature Conservancy of Hawai‘i. 1997. *Kanepu‘u Preserve, Lana‘i, Hawai‘i. Long-Range Management Plan. Fiscal Years 1998-2003.* The Nature Conservancy of Hawai‘i. Honolulu, HI. August 1996, Revised March 1997.

The Nature Conservancy of Hawai‘i. 1997. *Final Environmental Assessment for Kanepu‘u Preserve, Natural Area Partnership*. Unpublished.

The Nature Conservancy of Hawai‘i. *Semi-annual Progress Report*, *Kanepu‘u Preserve, Lana‘i, Hawai‘i.* Unpublished documents prepared for the Department of Land and Natural Resources Natural Area Partnership Program and Dole Foods, Inc. Prepared annually; reports for 1992 – 2002 are available.

The Nature Conservancy of Hawai‘i. *Operational Plan and Progress Report*, *Kanepu‘u Preserve, Lana‘i, Hawai‘i.* Unpublished documents prepared for the Department of Land and Natural Resources Natural Area Partnership Program and Dole Foods, Inc. Prepared annually; reports for 1992 – 2002 are available.

The Nature Conservancy. 1998. *Redesigning the Nature Conservancy of Hawai‘i for Maximum Conservation Impact*. Unpublished.

Scientific Research and Restoration

Cory, Coleen. 1999. *Kanepu'u Conservation and Restoration: A plan to conserve and restore the olopua/lama dry forest community of Kanepu'u Preserve, Lana'i.* July 1999. The Nature Conservancy of Hawai'i. Honolulu, HI.

Cory, Coleen. 1998. *Kanepu'u Preserve, Lana'i - Vegetation Monitoring. March and May 1997*. The Nature Conservancy of Hawai'i. Honolulu, HI.

Dunn, Patrick. 1995. *Vegetation Monitoring of Kanepu'u Preserve, Lana'i - 1994*. Draft Report. The Nature Conservancy of Hawai'i. Honolulu, HI.

HDOA - Hawai'i State Department of Agriculture, Division of Plant Industry, Weed Branch. 1963. *Noxious Weed Survey of Island of Lana'i*. Hawai'i State Department of Agriculture, Division of Plant Industry, Weed Branch. Honolulu, HI. February 1963.

Herr, John C. 1992. Kanepu'u Arthropods. Unpublished list from field survey in 1991. Produced for The Nature Conservancy of Hawai'i. Honolulu, HI.

Spence, Glen E., and Steven L. Montgomery. 1976. Ecology of the Dryland Forest at Kanepu'u, Island of Lana'i. *Newsletter of the Hawaiian Botanical Society* 15 (4/5): 62-80. October/December 1976.

Stratton, Elisa C. 1997. *Ecophysiological Adaptations to Water Resource Limitations in Kanepu'u Dry Forest, Lana'i, Hawai'i*. Ph.D. Dissertation. University of Hawai'i, Manoa. Honolulu, HI.

Suenaga, Nova. 1996. *Survey of Vegetation in Kanepu'u Preserve on Lana'i*. Unpublished report. The Nature Conservancy of Hawai'i. Honolulu, HI.

TNCH - The Nature Conservancy of Hawai'i. 1991. Unpublished report on Land snail shells from soil sample collected by Heidi Bornhorst (TNCH) at Upper Paoma'i unit of Kanepu'u Preserve, April 1991 and identified by Rob Cowie (BISH) August 1991. The Nature Conservancy of Hawai'i, Honolulu, HI.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service Animal Damage Control. 1995. *Report of Rodent Assessment Conducted in the Kanepu'u Easement, Lana'i, Hawai'i*. Unpublished document prepared for The Nature Conservancy of Hawai'i.

Ziegler, Marjorie F. Y. 1986. *The Cultural and Natural History of Kanepu'u, Lana'i and its Potential for a Natural Area Preserve*. University of Hawai'i Manoa, Senior Honors Thesis.

Ziegler, Marjorie F. Y. 1989. Kanepu'u: A remnant dry forest on Lana'i, Hawai'i. *The 'Elepaio* 49(4): 17–24.

Historical Documents

Degener, Otto. 1963. Botanists' Expedition on Lana'i. *Hawaiian Botanical Society Newsletter*, October 1963: 107-108.

Fosberg, F. Raymond. 1936. Plant Collecting on Lana'i, 1935. *Mid-Pacific Magazine*. April-June 1936: 119-123.

Graf, William and Lyman Nichols Jr. 1967. The Axis Deer in Hawai'i. *Journal of the Bombay Natural History Society* 63 (3): 629-734.

Hobdy, Robert. 1993. Lana'i - A case study: The loss of biodiversity on a small Hawaiian island. *Pacific Science* 47 (3): 201-210.

Munro, George C. c1930. Personal Notes and Letters.

Munro, George C. 1960. *The Story of Lana'i*. Unpublished manuscript. Library, B.P. Bishop Museum. Honolulu, HI.

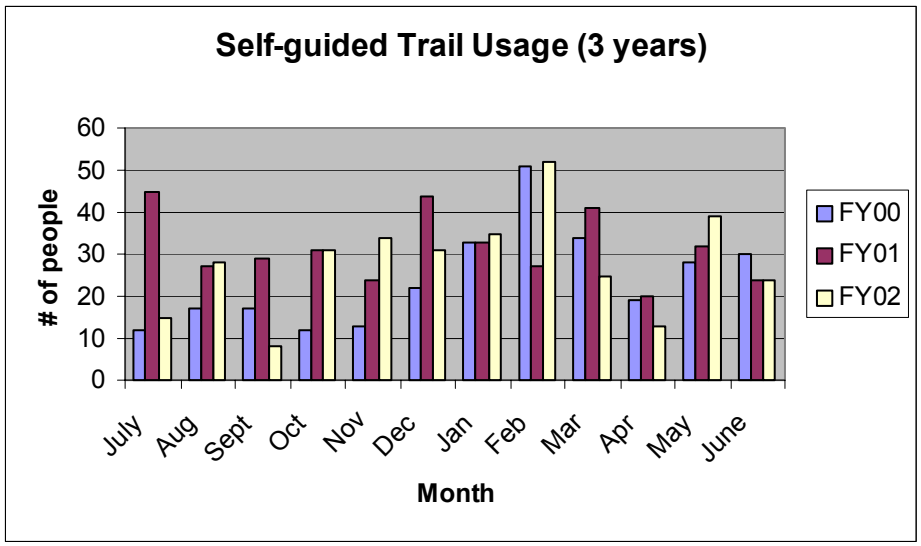
Munro, George C. 1952. Revisiting the Island of Lana'i in 1952. *The 'Elepaio* 12 (10): 62-64.

APPENDIX 3
SELF-GUIDED TRAIL USE AT KANEPU'U PRESERVE

Self-Guided Trail Use

	FY00	FY01	FY02
Total Visitors	288	377	335
United States*	226	280	252
Hawaii**	42	73	65
International***	20	24	18
Lanai City	7	14	2

*United States residents, not including Hawaii residents
** Hawaii residents, including Lanai City residents
*** International residents include Japan, Canada, England, Switzerland, Sweden, Denmark, the



Comments Received:

- Interesting contrast to resort/villa – MN
- Very educational –IL
- Heard about from TNC website, long time supporters – NY
- Confused as to whether it is okay to walk this trail (hunter safety warning) – AK
- Signs for endangered plants (pointing them out) would be informative – HI
- More signage along path in and out – CA
- Heard via Foder's guide book – CT
- Saw driving by and in guide book – AK
- Proud to be members of TNCH! Good job. – HI
- Excellent preserve and tour. Please expand. – Japan
- Trail should be longer (several groups)
- We're concerned to see the fence down and the deer tracks in the preserve. – HI